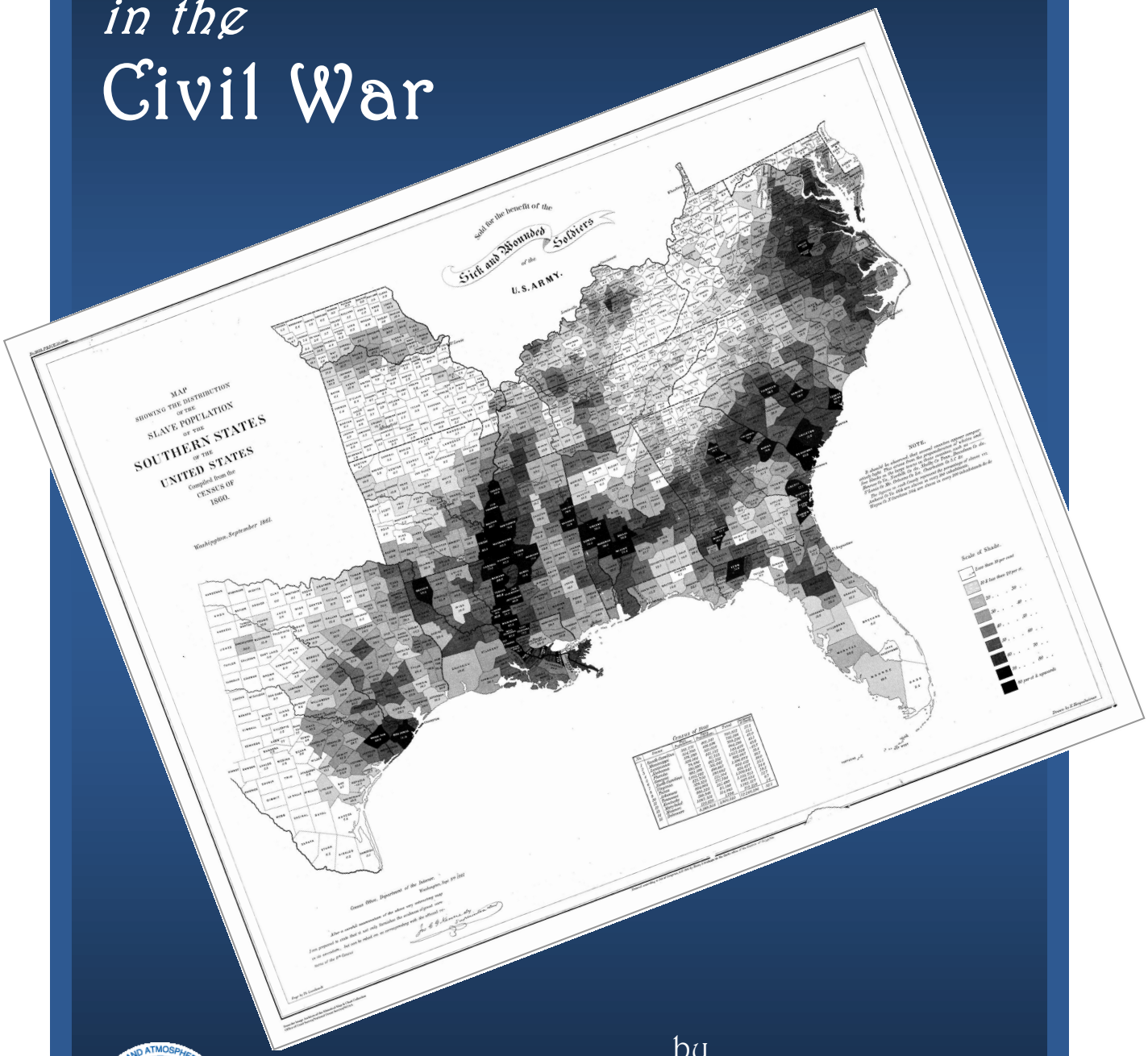
The U.S. Coast Survey *in the* Civil War



by

John Cloud, Ph.D.

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The Office of Coast Survey's "Charting a More Perfect Union" project was supported by the NOAA *Preserve America* Initiative, part of *Preserve America*, a federal initiative aimed at preserving, protecting and promoting our nation's rich heritage.

The cover image — *Map Showing the Distribution of the Slave Population of the Southern States* — is free for download from the Office of Coast Survey Special Collection, "Charting a More Perfect Union." For this image, and nearly 400 more Civil War-era charts and maps, go to http: nauticalcharts.noaa.gov/history/CivilWar

Table of Contents

Introduction 5

The Coast Survey Under Bache Before the War (1843-1858) 6

George Mathiot, E. B. Hunt, and Coast Survey cartography 8

The Coast Survey Prepares for War (1858-1860) 11

Coast Survey moves men and ships 13

Rebels harass Surveyors 14

The Coast Survey Goes to War (1861-1865) 15

The Notes on the Coast 18

Coast Survey and the Slavery Maps 21

Mapping the New Coast of the Rebellion 24

The Aftermath of the War and Bache's Death (1865-1867) 29

The U.S. Coast Survey in the Civil War

Introduction

The U.S. Coast Survey began in 1807 as the Survey of the Coast, authorized by Congress and developed by President Thomas Jefferson. Ferdinand Hassler, the Swiss emigrant scientist, proposed the scientific enterprise and directed it, most of the time, until his death in 1843. (For the most complete history of the early U.S. Coast Survey, please see Albert E. Theberge, Jr.'s history.[1])

Following Hassler's death, Alexander Dallas Bache (1806-1867) became the second Superintendent of the U.S. Coast Survey and remained its nominal leader until his death. Hence, the history of the Coast Survey in the Civil War is almost entirely under his leadership. In late 1864, Bache was incapacitated by something like an aneurysm while directing the construction of fortifications outside Philadelphia to protect that city from Confederate attack. Although Bache lived until 1867, he was effectively gone physically and mentally after his attack, and so Bache was yet another of the hundreds of thousands of casualties of the Civil War.

The Civil War, as commonly known, took place in 1861-1865, although the crises that led to the war preceded the battles by decades. The many roles played by the U.S. Coast Survey in the war can best be considered by looking at four periods:

(1) The Coast Survey under Bache before the war (1843-1858)

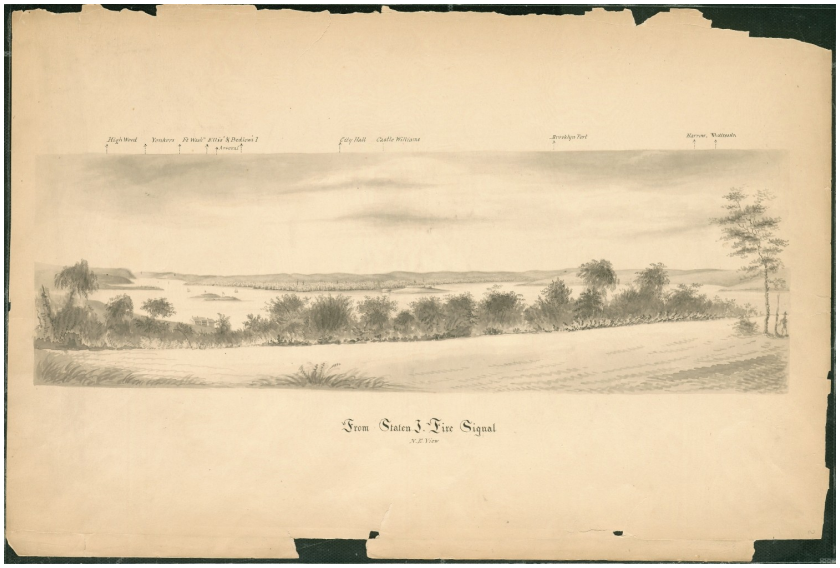
(2) The Coast Survey prepares for war (1858-1861)

(3) The Coast Survey in battle (1861-1865)

(4) The aftermath of the war and the transition after Bache's death (1865-1867)

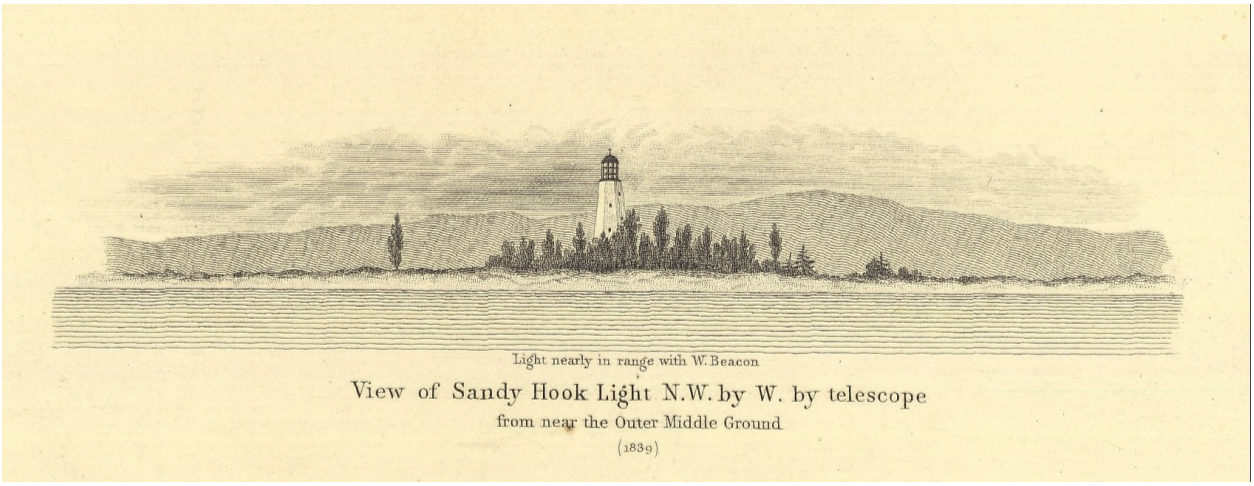
The Coast Survey under Bache before the War (1843-1858)

The U.S. Coast Survey, as initiated by Hassler and developed under Bache, was the major scientific agency in the U.S. government. Hassler founded the agency as a geodetic survey, designed to create a coastal geodetic triangulation network of stations, occasional carefully measured baselines, and geographic positions based on astronomical observations. This network system began at and around the bay and harbor of New York. It was to be extended by Hassler both along the Atlantic coast and inland overland and along the Hudson River.



New York City as seen from the Fire Signal on Staten Island, 1840, by Lt. John Farley (NOAA Central Library Rare Book Room)

The U.S. Coast Survey was a civilian agency but, from the beginning, officers and men from the U.S. Navy and U.S. Army were detailed to service with the Survey, and U.S. Navy ships were also detailed to its use. In general, Army officers worked on topographic surveys on the land and related maps based on the surveys, while Navy officers in general worked on hydrographic surveys in coastal waters. These surveys were closely related, and generally conducted simultaneously using the same coastal triangulation stations. Lt. John Farley, the first great artist associated with the Survey, produced views from hilltop geodetic stations, and coastal views of lighthouses and harbor entrances as seen from ships at sea.

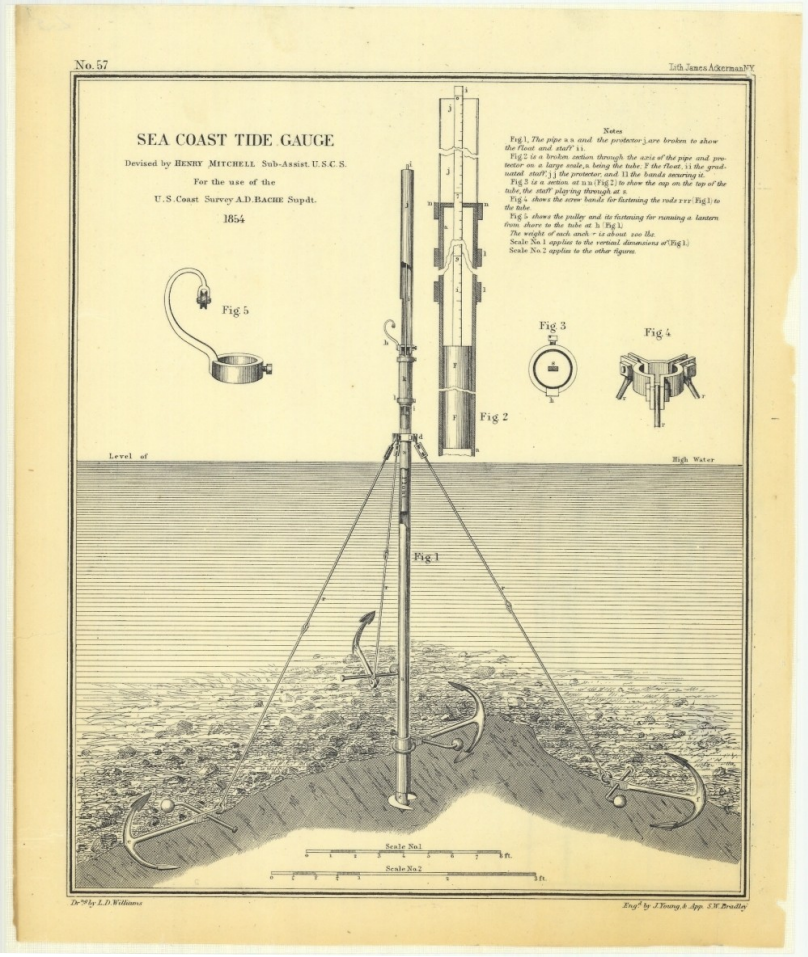


View of Sandy Hook Light House, 1839, by Lt. John Farley, from New York Bay and Harbor and the Environs, Sheet No. 1, 1844

Ferdinand Hassler died in 1843, as a result of injuries during fieldwork. When Bache succeeded Hassler, he quickly introduced major changes in the organization of the Survey. Instead of continuing to radiate out from New York Bay, Bache divided the Atlantic coast, and later the Gulf and Pacific coasts, into numbered sections of the coast. He insisted that survey work proceed in every section, every year. As a result, Survey personnel, both civilian and military, started acquiring expert knowledge of much of the terrain and waters upon which the later war would be fought. Because he had been stationed with the Survey in Georgia prior to the Civil War, General William Tecumseh Sherman remarked that he “knew more about Georgia than the Georgians."

Also, the military officers in both branches learned expert skills in the Survey, which they could utilize back within their own ranks during the war. As Superintendent Bache noted, “While the obligations of the survey to the officers of the Army and Navy serving on it are freely and fully acknowledged, it should not be forgotten that, on the other hand, the work serves as a school of practice for them, and thus gives while it receives."[2]

Bache, the great grandson of Benjamin Franklin, was one of the major scientists of his era. He introduced telegraph use as a geodetic instrument, using it to determine differences in time of astronomical observations at different stations that correlated with differences in longitude. While Bache was not unique in this application, he developed the methodology that became standard, and the Survey’s technique became known in Europe as “the American method.” Bache also initiated major investigation of terrestrial magnetism, the changing geo-magnetic fields as sensed through local observations, which was critical to determining magnetic variation in compass needles in the field. That determination, in turn, was critical to every manner of military activity.



Sea Coast Tide Gauge by Henry Mitchell. Figure No. 57, Annual Report of the Superintendent for the year 1854

The instruments and techniques for topographic mapping were well established and based on European methods, largely associated with military engineering and cartography. Hassler, in fact, taught at the U.S. Army Academy at West Point between periods of his service with the Coast Survey. Hydrography in the Survey was different. Under Bache, the Survey developed new instruments to

The Survey Ship ACTIVE (1852-1861), the first ship of the Coast Survey on the West Coast. NOAA Photo Library, www.photolib.noaa.gov/htmls/ship0056.htm

determine and measure tides and current which later became critical during the war. One notable example of that was Henry Mitchell's seacoast tide gauge, a relatively small and quite portable instrument designed for use in the surf or in other bodies of moving water.

In addition to pioneering the telegraph as a geodetic instrument, Bache also pioneered the use of steamships as hydrographic instruments. Following the Mexican War, in 1850 the Coast Survey acquired responsibilities for geodesy and cartography on the Pacific Coast, along the new territories of California, Oregon, and Washington. The major access routes to the Pacific for the Survey were by steamships to and from Panama, then overland to the Pacific, and from there by different steamships to California and beyond. The first two Survey ships in service on the west coast, the EWING and the ACTIVE, were sailed around the Straits of Magellan to the Pacific. But after that, all ships used by the Survey on the Pacific Ocean were powered boats.

To summarize these broad points, in the years under Bache before the war, the Survey and its associated military officers in both services gained a broad familiarity with many areas of the country, particularly the coastal areas of the southern states, where much of the Civil War would later be fought. They developed and invented or acquired new instruments, particularly emphasizing reduction in weight and size without impairing accuracy—instrument traits ideal for wartime applications. And, unlike the U.S. Navy, the Survey made the transition from sailing vessels to powered steamships well before the war, with important implications for their later military service.

George Mathiot, C. B. Hunt, and Coast Survey cartography

Superintendent Hassler was a progressive European who applied European instruments in the New World. His cartography was based on creating engraved copper plates used to produce limited numbers of wonderfully detailed but necessarily expensive maps and charts. His engravers worked for many years to create the set of six copper plates comprising the set of sheets of New York Bay and Harbor and the Environs. None of these were finished by the time of his untimely death in 1843.

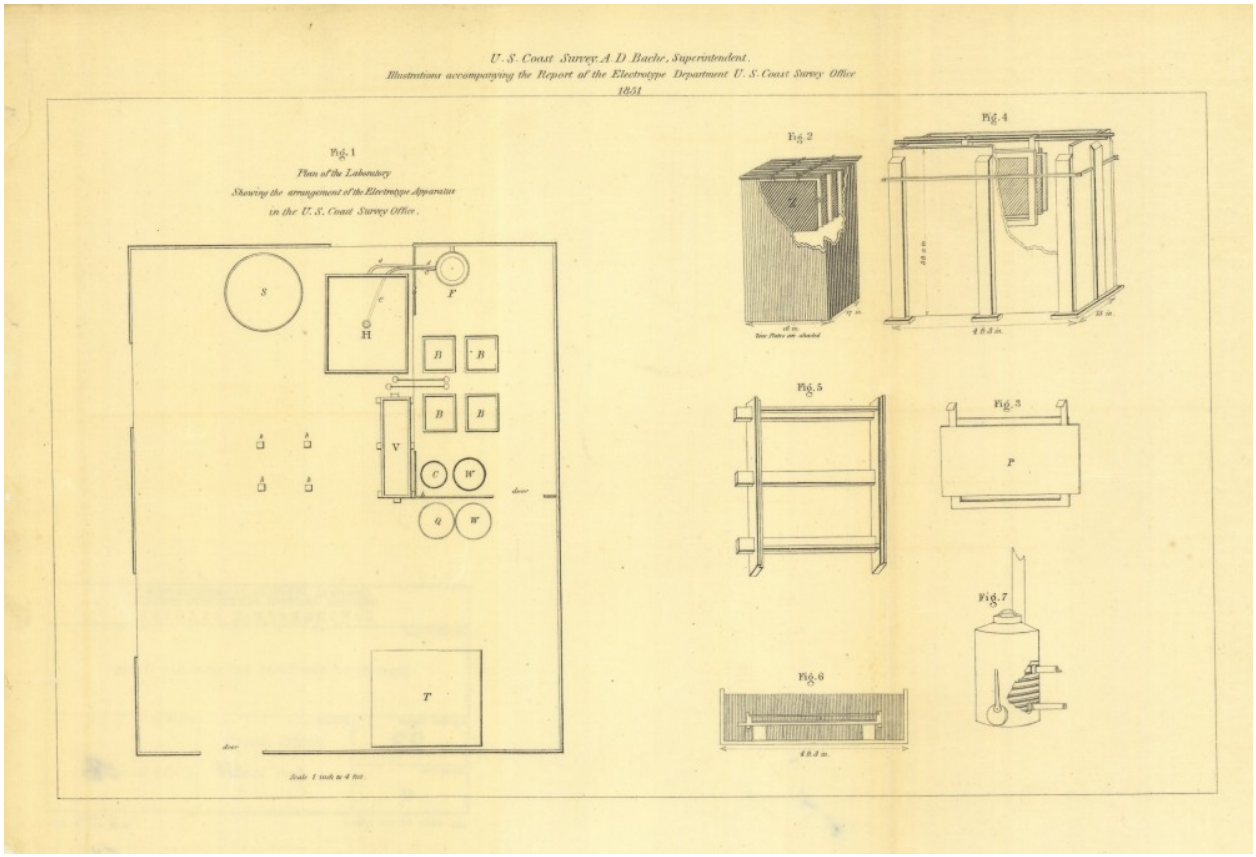
Superintendent Bache redoubled work on the plates, and published editions of the first four sheets in 1844. In 1845, his engravers completed the remaining two plates, and prepared a re-scaled and enlarged one-sheet version of the New York map. After that, Coast Survey cartography quickly developed. Bache wanted maps produced for parts of every one of the Survey's new sections, and every year. He also wanted copies of these new maps readily distributed to Congressmen representing areas on the maps, and Congressmen who controlled his budget. And he genuinely wanted the largest quantities of the highest quality maps to be printed and distributed.

The major impediment in the whole process was the engraved copper plate. The Survey had ready access to skilled European emigrants, particularly from German and French territories, who were master engravers. But their work took years for a single plate, and was very expensive. After several hundred impressions, the soft copper plates would lose sharpness of detail, and eventually the once expensive plate was worthless.

In the 1840s, the process of electrotype plating was invented in Europe. The process allowed production of replica copies of original copper plates, using systems of vats of metallic salts with electrical currents running through them. These copies were exactly opposite the original copper engraved plate. The first copy — the *alto* copy — featured elevated ridges where the original plate had engraved grooves. The alto was then copied, which created an opposite copy, with grooves instead of ridge — the *basso*. The basso was, if made correctly, an almost exact copy of the original copper. Prints could then be pulled on the press, using the basso, until it was degraded. Then another copy could be made, using the original alto, and the process continued. With this system, a virtually unlimited number of high quality engravings could be printed, reserving the original plates and altos to reproduce bassos as needed. The system surmounted the problem of the copper plate originals, but it required the highest-level technologies of electricity and metallurgy of the era to work.

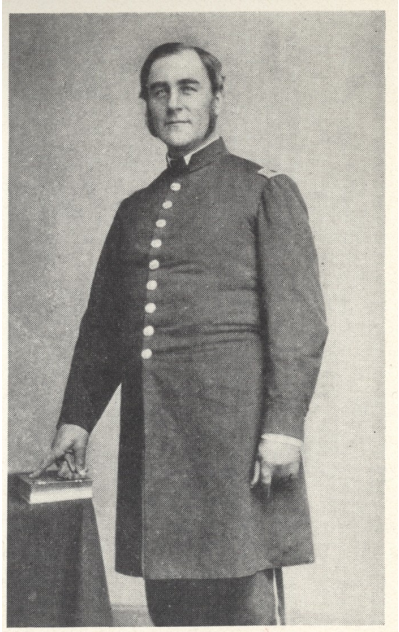
Bache brought in Army Brevet Major Isaac I. Stevens to be Assistant-in-Charge of the Office to re-organize the functions of the Survey. Major Stevens divided the office into seven functional areas: 1) computing; 2) drawing; 3) engraving; 4) electrotyping; 5) printing; 6) publishing, distribution, and sale; and 7) instrument-making. The following year a library and archives division was added, as was a tidal computing division in 1855.

Bache brought in two highly skilled men to develop the electrotype system for the Survey. One, E.B. Hunt, was a polymath genius who performed many roles in the Survey. Hunt was in charge of the new engraving



Electrotype Laboratory
Sketch X, Annual Report for the year 1851.

division. (He was the husband of Helen Hunt, and after his untimely death while working on Civil War weapons, she remarried as Helen Hunt Jackson, the famous late 19th century author.) Hunt's tenure in the office was short; he later left the Survey to become the Military Governor of Washington Territory, and was killed in battle in the early Civil War. George Mathiot headed the new electrotype laboratory. Mathiot was the leader in electrical applications research, designing the first working electrotype system in the New World.



MAJOR EDWARD BISSELL HUNT

NOAA Photo Library
www.photolib.noaa.gov/htmls/pers0334.htm

The far-sighted Bache also realized a new technology – photography – would have a major impact on the Survey. In the early 1850s, he ordered the personnel in the Survey divisions to explore new methods for showing terrain by shaded relief in engraving. He also asked them to explore the potential applications of lithography for printing maps more cheaply and easily. This process began by developing methods to reproduce Survey engraved maps, which were printed on heavy, expensive paper. Lithographic copies, on the other hand, could be printed on cheaper and far thinner paper, which could be folded and then sewn into the massive volume of the annual report. And he asked them to explore methods to allow rapid transfer and rescaling of details from the Survey's original unpublished manuscript maps, to their published maps. The key technology that would tie together these practices, from the field sheet in the country to the published chart in the office, was photography.

In 1859 and 1860, the Survey personnel published a series of reports, as appendices in the annual reports, detailing the work they had been performing for almost a decade. George Mathiot was definitive:

> *"I have sought to make use of the photograph in the construction of our charts. I emphasize construction in order that I may direct attention to the true object of our labors. That facility, which the photograph offers for copying, and its almost universal employment for this purpose, causes the idea to be very generally entertained that we are endeavoring to multiple copies of our charts by photography. Such, however, would be to employ photography for the multiplication or publication of the charts, instead of their construction. But the latter being the true purpose, and the construction of the chart being an operation founded on the methods and purposes of every department of the survey, it will be seen that the proposition to employ photography in making the charts involves no trifling considerations, and prospectively may affect every branch of the survey."* [3]

So now, at last, the many elements of the pre-war Survey converge, for application to a set of tasks completely outside their anticipated objectives when they Survey developed them. The broad familiarity with American coastlines and waterways, the use of steam ships, the reorganization of the entire Survey structure based around the successful developments of new technologies for map construction, and the resident community of an entire generation of skilled military and civilian personnel—these formed the foundation for the performance of the Survey in the Civil War.

The Coast Survey Prepares for War (1858-1860)

The first indication of the changes in the Coast Survey as war approached was the reduction in fieldwork on the Pacific coast. Both hydrographic and topographic survey parties returned steadily to the east, leaving a small field staff primarily working on completing the topographic surveys of San Francisco Bay. Map compilation and production based on previous fieldwork continued, but clearly, by 1858 the Survey was anticipating war on the Atlantic and Gulf coasts.

By 1858, Survey field parties had worked along portions of the entire coastline of the slave-holding states, to the Mexican border. This work was discontinuous, however, and in many cases, harbor surveys only 10 years old were quite obsolete. Bache redoubled efforts to fill in missing areas of the coast, and to survey strategic areas. One of the highest priorities was Charleston, South Carolina. The harbor was one of the most important ports in American commerce, its approaches were ringed by military bases and forts—and it was the hothouse of pro-slavery rebellion. The Survey worked intensely all around the harbor.

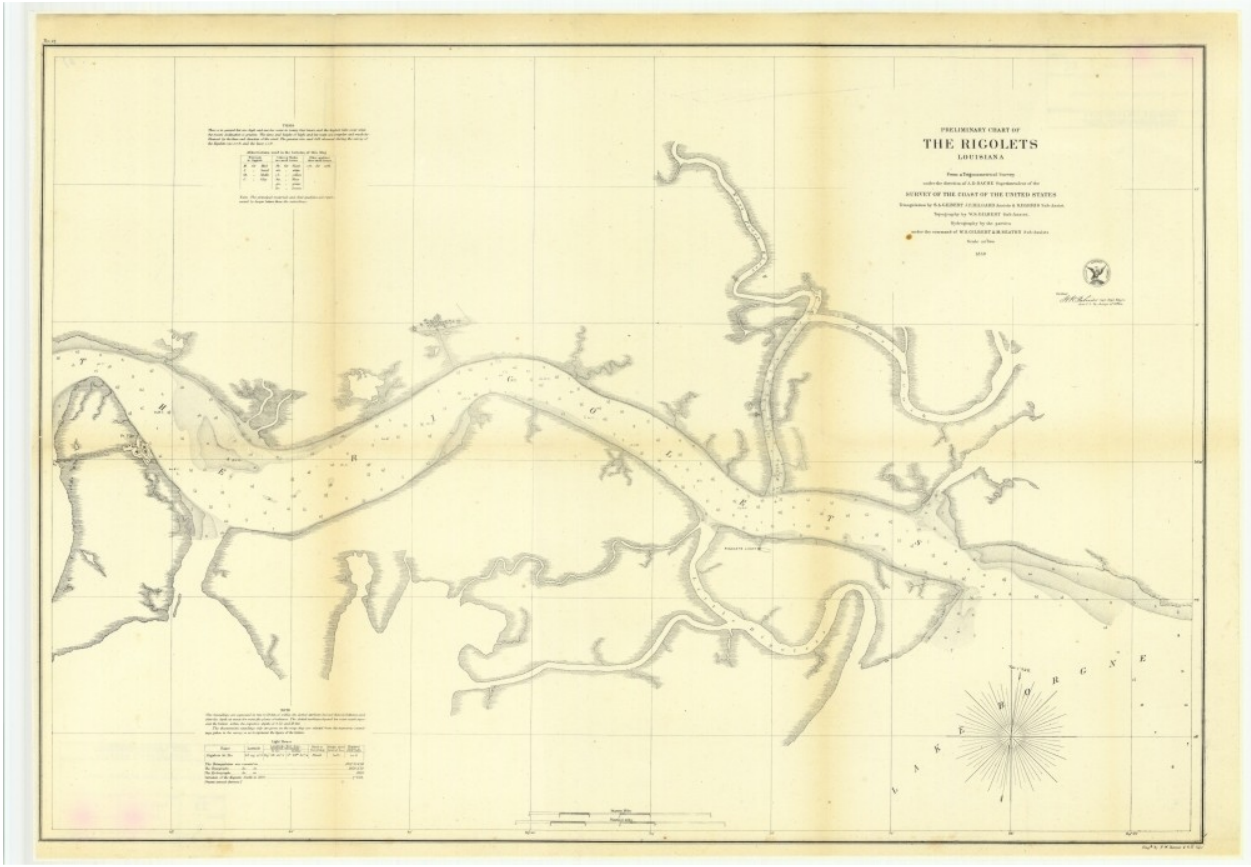
By 1859, many of the production standards of the Survey had been modified, combining rapid field work to characterize strategic passages and channels, with diminished emphasis on comparable topographic

A portion o f T-170 Charleston and its Vicinity (1858). Based on fieldwork in 1857-1858.

surveying of the borders of the channels. The 1859 chart of the Rigolets, main ship passageway between the Gulf of Mexico and Lake Pontchartrain, above New Orleans, is characteristic of the new regime.

On November 6, 1860, Abraham Lincoln was elected President. A little over a month later, on December 10, the South Carolina legislature passed a law calling for a secession convention, and the two Senators from the state resigned their seats. On December 20, South Carolina seceded. Events began to move quickly. On January 9, Mississippi followed. On January 19, it was Georgia.

Within a few days of South Carolina's secession, state officials seized two Coast Survey vessels; the schooner PETREL and the small steam tender FIRE FLY. The PETREL had a bizarre fate, while the FIRE FLY almost survived the war, ultimately being burned at Savannah, Georgia, by the Confederates to prevent recapture in late 1864. Conversely, the PETREL was among the first ships lost to the Confederate cause.



1859 Sketch 27, Annual Report for the year 1859

PETREL was in the care of a private citizen of Charleston at the time of its seizure, having been left there under contract for caretaking in May 1860. The ship required extensive repairs and was in such poor condition that the Confederate Navy ultimately rejected it. However, a group of Charleston entrepreneurs invested in refurbishing it as one of the first Confederate privateers. Thus, before dawn on the morning of July 28, 1861, the PETREL sailed out of Charleston and evaded the Union blockaders guarding the harbor entrance. At first light, William Perry, the captain of a schooner, spied a large sail on the horizon and gave chase. Unfortunately for the PETREL, the schooner turned out to be the Union frigate ST. LAWRENCE,

carrying 52 guns to the PETREL's two guns. The ST. LAWRENCE rapidly appraised the situation and commenced chasing the privateer. At 10:00 a.m., it caught up with the PETREL. At this point, the captain of the PETREL foolishly ran up the Confederate flag and began firing at the powerful frigate. The Union ship only fired once and sank the PETREL with an 8-inch shell. Perry and his surviving crew were captured, manacled, and sent to a federal prison in Philadelphia, ending the short inglorious career of the PETREL.

Coast Survey moves men and ships

Earlier in the year, survey work scheduled for South Carolina was cancelled as Assistant C. P. Bolles, who had orders to work at Winyah Bay, "... judged, in consequence of the attitude taken by the authorities of the State of South Carolina... that it would be inexpedient to resume the field work...." Bolles, a resident of North Carolina, probably saved Coast Survey instruments and equipment from being expropriated by South Carolina officials. It hardly mattered, however, as he resigned from the Survey on April 20 and retained the "small vessel, the instruments that had been in the use of his party, and other property belonging to the government, including plane-table sheet No. 725, and the sheets containing the topography executed by Mr. Hinrichs in the working season of 1859-60..."[4]

Perhaps reflecting the state of confusion prevalent in the seceding states and their relationship to the United States in the early months of 1861, the Coast Survey office continued receiving records "from the self-registering tide-gauge at the Charleston custom-house, S.C., ... up to the 22nd of April last from the observer, Mr. W. R. Herron, and the gauge was known to be in operation on the 4th of May. After that time, postal intercourse being suspended, no information has been received in regard to the observations." All during the early months of 1861, tidal records were received from the seceding states. The self-registering tide gauge at the Union fort at Tortugas continued observations until May 1, but was discontinued because of "frequent interruptions from the jar produced by the firing of heavy guns at the fort" during firing exercises. There was no further need for this station, as it was the standard of reference for the other Gulf Coast stations under Confederate control, and observations were terminated.

Numerous survey parties were at work or scheduled to begin work along the coast of Florida in the winter of 1860-1861. On January 10, 1861, Florida became the third state to secede from the Union. (Mississippi seceded the day before.) Because of the probability of disruption by hostile parties, Coast Survey cancelled a project to connect the triangulation across the Florida peninsula from Fernandina to Gainesville, and thence on to Cedar Keys on the west coast. Coastal triangulation work in Pensacola Bay was cancelled, as the chief of party, F. H. Gerdes, observed that “the public excitement was such as to endanger the possession of the two vessels under his charge." Accordingly, he directed his survey vessels, the JAMES HALL and the GERDES, to Passe-a-Loutre, at the mouth of the Mississippi River, but found the same state of agitation prevalent there as in Pensacola, despite Louisiana not seceding as yet. On January 31, five days after secession, Louisiana seized the USRC WASHINGTON, which was in shipyard at New Orleans. This same vessel had accomplished early oceanographic work with the Coast Survey and weathered the hurricane of September 8, 1846. The Confederates scuttled the WASHINGTON the following year, when Farragut took New Orleans.

Next, Gerdes ordered his vessels to New York City, arriving in early February.

Similarly, Coast Survey terminated work at Indian River by the schooner PEIRCE and at St. Joseph's Bay by the schooner TORREY because of local hostility, and both vessels left Florida waters in February.

F. W. Dorr, on the schooner DANA, was working in the vicinity of St. Augustine, but left for New York City on January 12 when "events followed which made it inexpedient to remain.... A boat and the camp equipage of a party... was detained by the authorities of the State...."

The party of Sub-Assistant N. S. Finney continued working on the northwest coast of Florida until February 11, when his surveying instruments and camp gear were demanded "by a committee of armed inhabitants of Bayport, in number about twenty." Fortunately, the instruments had just been sent off in a boat to the schooner JOSEPH HENRY, but "the tent and camp fixtures were... necessarily relinquished to the chairman of the committee, Mr. C. T. Jenkins." Incredibly, relative to the later carnage and lack of concern for property during the Civil War, Jenkins signed a receipt for the equipment, which Finney sent to the Coast Survey office. Jenkins also allowed Finney and his aid, L. L. Nicholson, to proceed to the ship.

Not all work was terminated, however, as the triangulation party of Lieutenant William R. Terrill, U. S. Army, continued operations in the Charlotte Harbor area of Florida's west coast even after learning in late January of Florida's secession. They completed their work in late February and the ship departed for New York via Tortugas.

After completing the season's work on topography of the Florida Keys, Sub-Assistant C. T. Iardella reported to the Coast Survey office in March, and proceeded to his home in Brentsville, Virginia, to ink the topographic sheet. As of the end of 1861, he had "not yet returned to the office, nor has any communication been received from him."[5]

Rebels harass Surveyors

Coast Surveyors on the Texas coast were not immune from harassment by armed "public safety" committees. The triangulation party of Lieutenant George Bell, U. S. Army, working northeast of Galveston, ceased operations on March 19 because of "the unfortunate and excited state of the country."[6] Instruments and camp gear in storage from a triangulation party were expropriated at Corpus Christi, as was a small boat on April 19. The Coast Survey schooner TWILIGHT, conducting tidal observations, was seized at Port Aransas, Texas, on April 20, and later served as a Confederate blockade runner. This vessel was seized by the deputy customs collector of the port with nine armed men when Assistant Andrew C. Mitchell, the brother of the famous astronomer Maria Mitchell and Henry Mitchell of the Survey, left the ship for a few days to go to Corpus Christi to cash a government check. (No facility in Port Aransas would honor a federal check.) Mitchell made it back to Washington, D. C., in May after considerable trouble.

North Carolina was the last state to leave the Union, voting for secession on May 20, 1861. However, this did not inhibit an armed party of North Carolina citizens from seizing the instruments and camp gear of a Coast Survey party working on Roanoke Island on April 30. Sub-Assistant John Mechan and his aide, Ferdinand R. Hassler, a grandson of the founder of the Coast Survey, were unharmed and returned to the office at Washington, D. C. Although most instruments seized from the Coast Survey parties were never recovered by Union forces, these particular instruments were discovered when Coast Survey topographers accompanying General W. T. Sherman on his march from Savannah, Georgia, to Goldsboro, North Carolina, encountered them at the arsenal in Fayetteville, North Carolina, on March 11, 1865.

The most unfortunate Coast Surveyor in this early period of the war was P. H. Donegan, the tide observer at Calcasieu Pass, Louisiana. He was left there by the TWILIGHT on March 14 and was to have been picked up

when the ship returned. Instead, he was stranded at Calcasieu Pass and continued his tidal observations. A committee of local citizens interviewed him at the beginning of April as to the nature of his business and allowed him to continue observations. His last communication with the office was on May 1, 1861, when he transmitted the April observations. He continued at Calcasieu Pass until July 11 when he was arrested as a prisoner of war and taken to Lake Charles for trial as a spy. A month later, he was taken to New Orleans where he explained his predicament to the governor of Louisiana. The governor was willing to release him, but the military commander of the city "met his explanations with personal abuse, and ordered his trial by court-martial as a spy; that he was thereupon handcuffed, marched to the common 'lockup.'" He was held for twenty-four hours without food and then "remanded to the parish prison, where he was kept for a like period without food..." Donegan "was there incarcerated... with seven acknowledged criminals, in a space so small and close that all had to sustain life by taking turns at a little hole in the door for air...." He was never tried as a spy and was ultimately released through the intercession of the British consul on November 15, 1861.[7]

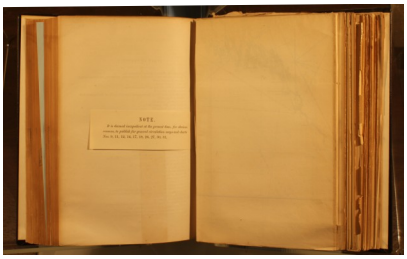
In addition to the personnel turmoil and enemy harassment of his field parties, Bache faced onerous developments at home: Congress looked upon the operations of the Survey as expendable in the year 1861. A much-reduced Congressional allocation of funds for 1861-1862 led to curtailment of Coast Survey activities right at the time that operations should have been expanding in support of Union forces. This was followed by an attempt by the House of Representatives to eliminate the Coast Survey appropriation for 1862-1863. It is a tribute to Bache as an administrator that he was able to overcome the disruptions of early 1861 and further build and direct an organization that would play a major role in determining much of the strategy and tactics of the Civil War.

The Coast Survey Goes to War (1861-1865)

In January 1861, Bache finished and published the Survey's annual report for the year 1860. The report made almost no mention of the gathering storm, apart from oblique statements about the rapid termination of certain survey parties here and there. But the report also included a small and subtle but rather extraordinary document. As in all of Bache's annual reports, the major portion of the volume, presented first, was the section of texts of the report and its many appendices. Following that was a second section, composed of folded lithographs of the figures and texts. The last page of the first, printed section was always a list of *Sketches and Figures*. In the 1860 report, the backside of the *Index of Sketches* had glued to it a very small printed piece of paper.

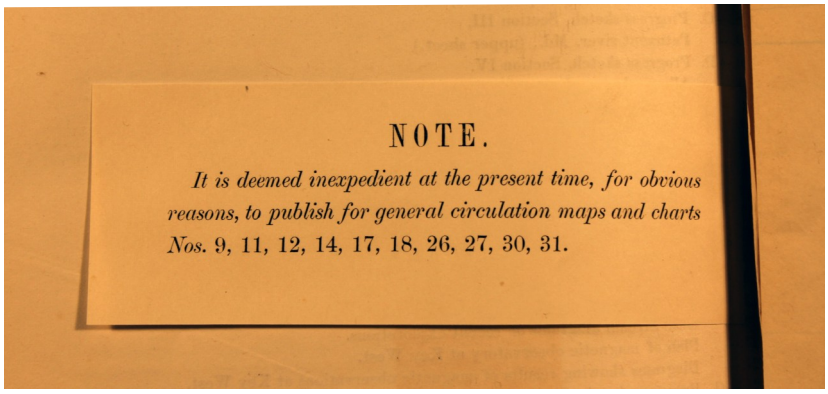
The small piece of paper notes that many of the maps and charts listed on the *List of Sketches* were not, in fact, bound in the volume. As the paper politely indicates: "It is deemed inexpedient at the present time, for obvious reasons, to publish for general circulation maps and charts Nos…" The ten charts covered coastal areas in the Mississippi Sound in the Gulf of Mexico, and coastal bays along the Florida coast and up the Atlantic coast to Chesapeake Bay. All charted areas were entirely the lands and waters of slave-holding states.

At the very same moment, however, the Survey, while not publishing the maps *for general circulation,* was in fact quietly in the early stages of



Annual Report for the year 1860
This copy is in the University of Wisconsin-Milwaukee Library.

an extraordinary project to publish the very same maps, plus many others, but to do so *secretly*. The secret project featured the deliberately innocuous name of *Notes on the Coast*.



NOTE.

It is deemed inexpedient at the present time, for obvious reasons, to publish for general circulation maps and charts Nos. 9, 11, 12, 14, 17, 18, 26, 27, 30, 31.

Note in the Annual Report for 1860

The genesis of the project was the Blockade Strategy Board, which also had an innocuous name: "Conference on Commission." This group organized to determine and deploy the Union naval strategy against the Rebellion, as they termed it. The seceding states controlled their territories, but they did not necessarily control the ocean adjacent to their shores. Further, much of the economy of the south was based on agricultural exports to Europe and Latin America. The Union's counter to the Rebellion was to encircle it like a snake. The blockade, declared by President Abraham Lincoln within a week of the beginning of hostilities, was an intrinsic part of the "Anaconda Plan," credited to General Winfield Scott, which was derisively named because of the similarity of the plan to the slow strangulation of the South by an anaconda.

Perhaps early on the plan did seem too conservative; however, the North ultimately won by following the basic tenets of Scott's plan.

Scott's Great Snake, by J.D.R. Elliott, 1861
In the Library of Congress, digital ID g3701s cw0011000

The Conference on Commission was composed of Coast Survey Superintendent Bache, Captain Samuel Francis Du Pont and Commander Charles H. Davis of the Navy, and Major John Gross Barnard of the Army. Commander Davis was a close friend of Bache, but also an astute observer of Bache's management style, and the ways in which he was transforming a civilian agency into an arm of the war effort. As he noted:

> *"Bache is wonderful in his way. The general expectation has been that the coast survey, being deprived of a large part of its field of usefulness, would decline in power and be reduced in occupation. Some of those kindhearted people, whose happiness is impaired by too much success and*

prosperity on the part of their neighbors, have remarked to Mr. Bache in a tone of condolence, but with a smile of satisfaction, that they supposed the coast survey would be stopped now. But, in fact, it has never been so distinguished and important as now. Bache's ingenuity has been exercised in discovering methods of making the coast survey cooperative in the great movement of the day. The new commission I have already spoken of; in addition to this, he has made special surveys, made and distributed maps of the seat of war, and, above all, he has managed so as to have calls made on his office for reconnaissances; and he is now, by means of his assistants, actually performing the duty of a topographical corps to this division of the army, for which service he has received the thanks and compliments of the President, the Secretary of War, and the general-in-chief. And his assistants will accompany the army in its advance, and from the active members of the topographical staff. He certainly possesses a very remarkable talent for this kind of government."[8]

The Blockade Strategy Board first met on June 27, 1861, under the chairmanship of Du Pont. The only personnel difference from Bache's suggested membership was Major Barnard of the Army Corps of Engineers (soon to become a Major General and Chief Engineer of the Army of the Potomac), who sat on the board instead of Brigadier General Joseph G. Totten. The Board considered the major problems of the blockade and planned amphibious operations for establishing vital bases along the Southern coast. According to the official United States Navy compendium *Civil War Naval Chronology 1861-1865*, "Recommendations made by the Blockade Strategy Board, an early example of a 'Joint Staff,' had a profound effect on the course of the conflict and pointed the way to the successful naval actions at Hatteras Inlet, Port Royal, and New Orleans. The broad policies the Board set forth were essentially followed to their culmination at Appomattox."[9]

To execute a naval blockade was a daunting task. The Potomac River and Chesapeake Bay to the Mexican border has over 3,500 miles of outer coastline and many more thousand miles of coastline counting islands, inlets, and interconnecting creeks and rivers. The geographic problem was compounded by a political problem: the British and Spanish were both sympathetic to the Southern cause and allowed the use of the Bahamas and Cuba as bases. At ports in those islands, large deep-draught merchant vessels would unload and then transfer their cargoes to small shallow-draught vessels. These vessels would then either follow circuitous routes via the meandering waterways of our southeastern coast to the major cities or offload their cargoes in secluded locations for land transport to railways. Such tactics significantly increased the extent of coast patrolled by Northern blockading ships.

The Blockade Strategy Board addressed these problems in a series of memoirs. These memoirs dealt with individual geographic regions of the Southeast coast. The first memoir dealt with the stretch of coast from Cape Henry, Virginia, to the southern limit of North Carolina; the second included the South Carolina coast; the third encompassed the Georgia coast and east coast of Florida; the fourth discussed the Gulf coast centered about the Mississippi River and approaches to New Orleans; and the fifth memoir dealt with the Florida Keys and reef, the west coast of Florida, western Louisiana, and Texas.

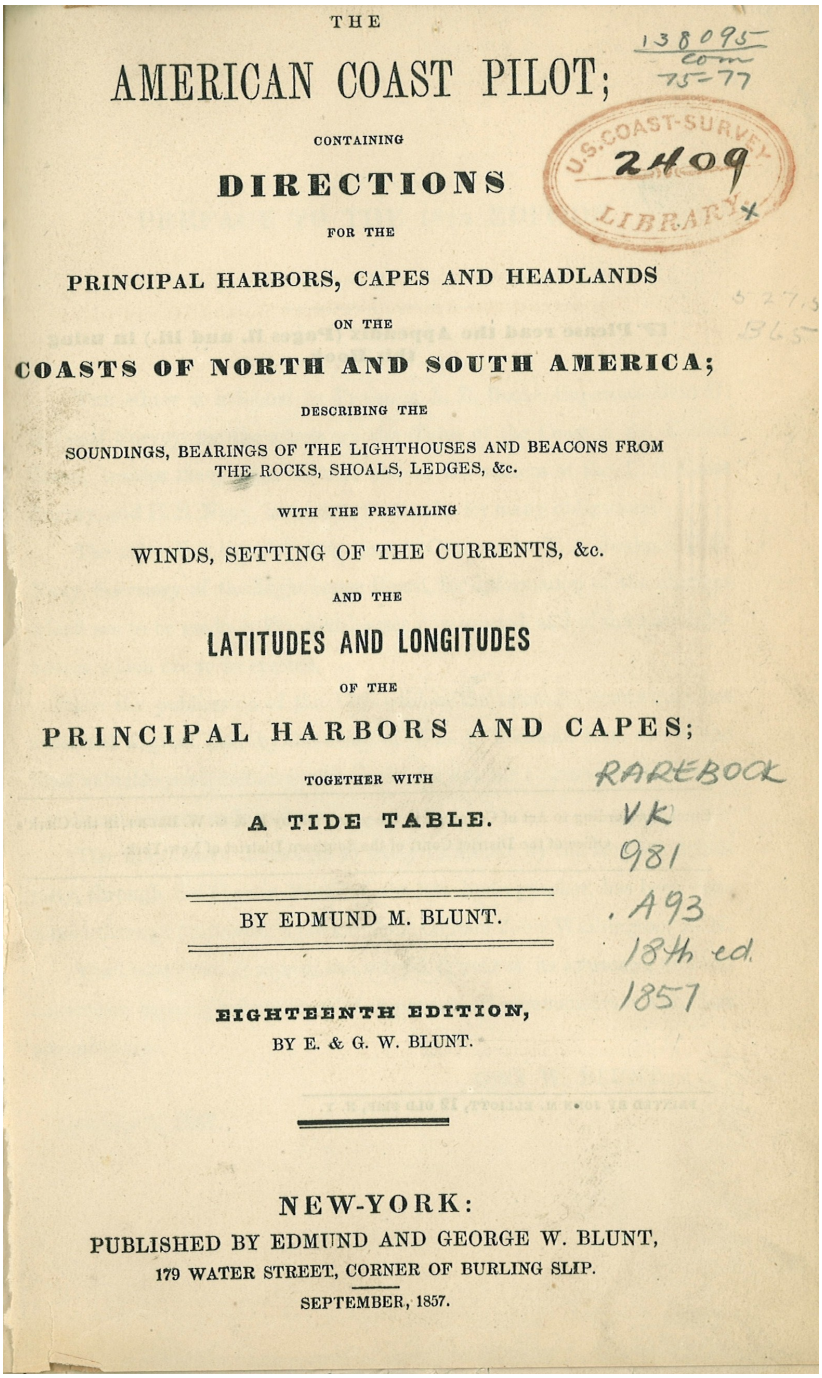
The unified plan for the blockade strategy was emerging but, to implement it the many disparate elements of the Union forces, both naval and army, would have to deploy to the right places in the right order, where they would encounter the rapidly forming Confederate navies. How could this be done, and as rapidly as possible?

The Notes on the Coast

Essentially, the Coast Survey had to devise coastal guidebooks and scientific aids, such as harbor charts, tide charts and wind and current manuals. Many of the scientific aids were already created and published in the Annual Reports. But these were large, heavy volumes of 600 or more pages, with many folded figures and sketches. So, in 1861, the Survey began creating compact stand-alone booklets derived from appendices in the reports. The Survey also had several decades of maps and charts of southern coastal waters and relevant data on tides, winds and currents, and magnetic declination. These too were reproduced for the new aids.

But these scientific aids alone could not serve as an adequate guide to navigate the difficult and dangerous—and now deadly—waters offshore from the Rebellion. It would take the synthesis of master mariners inside and outside the Survey to achieve this. For decades, the Survey had worked cooperatively with the Blunt family of Massachusetts, publishers of the *American Coast Pilot* series. The most recent edition available for the war effort was the 1857 revision. The *American Coast Pilot* was masterful and authoritative, but it was designed to assist the mariner in getting from here to *there*. The Coast Survey needed a guide detailing why one would want to go *there* in the first place, and what the strategic significance of *there* was.

These new objectives were realized in the series of memoirs called the "*Notes on the Coast*," which were soft-cover stitched books with attached sewn-in folded maps. Published in 12 volumes, from Delaware Bay to the coast of Texas, they were created for the use of the Union blockading squadrons.



THE

AMERICAN COAST PILOT;

CONTAINING

DIRECTIONS

FOR THE

PRINCIPAL HARBORS, CAPES AND HEADLANDS

ON THE

COASTS OF NORTH AND SOUTH AMERICA;

DESCRIBING THE

SOUNDINGS, BEARINGS OF THE LIGHTHOUSES AND BEACONS FROM THE ROCKS, SHOALS, LEDGES, &c.

WITH THE PREVAILING

WINDS, SETTING OF THE CURRENTS, &c.

AND THE

LATITUDES AND LONGITUDES

OF THE

PRINCIPAL HARBORS AND CAPES;

TOGETHER WITH

A TIDE TABLE.

BY EDMUND M. BLUNT.

EIGHTEENTH EDITION,

BY E. & G. W. BLUNT.

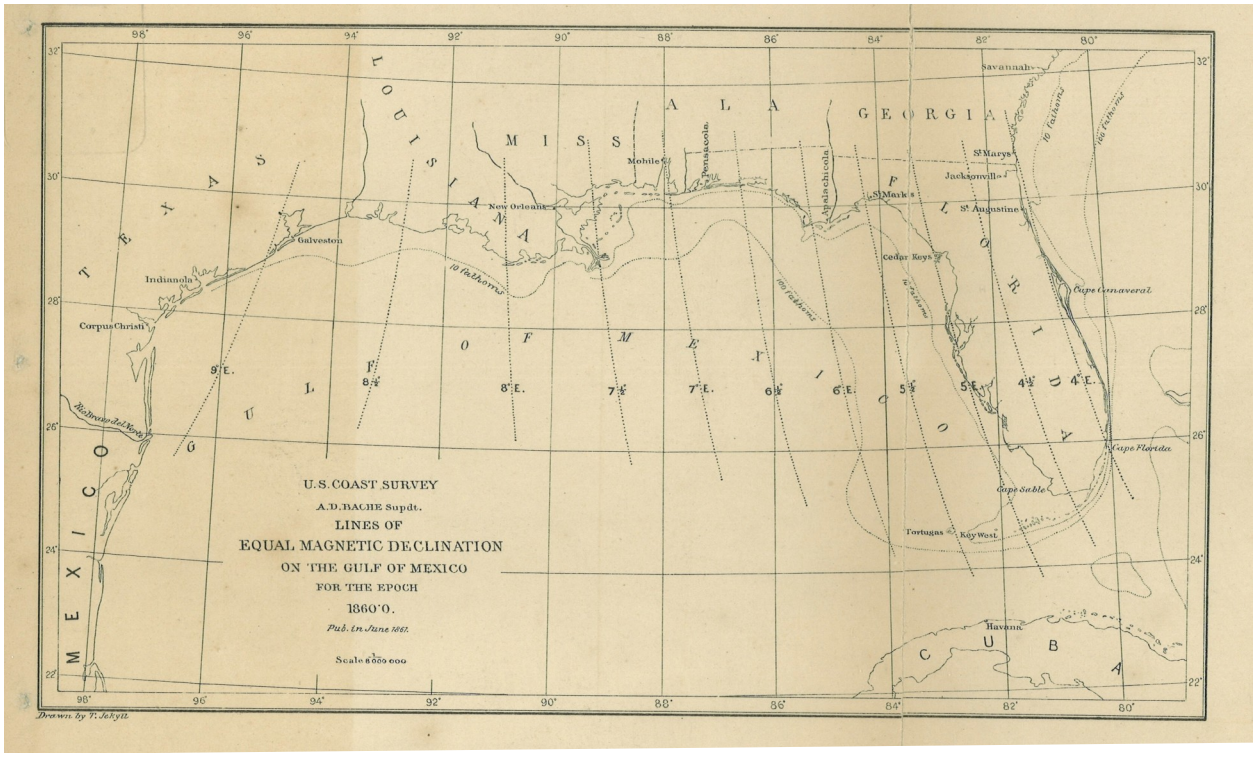
NEW-YORK:

PUBLISHED BY EDMUND AND GEORGE W. BLUNT,

179 WATER STREET, CORNER OF BURLING SLIP.

SEPTEMBER, 1857.

1857 American Coast Pilot



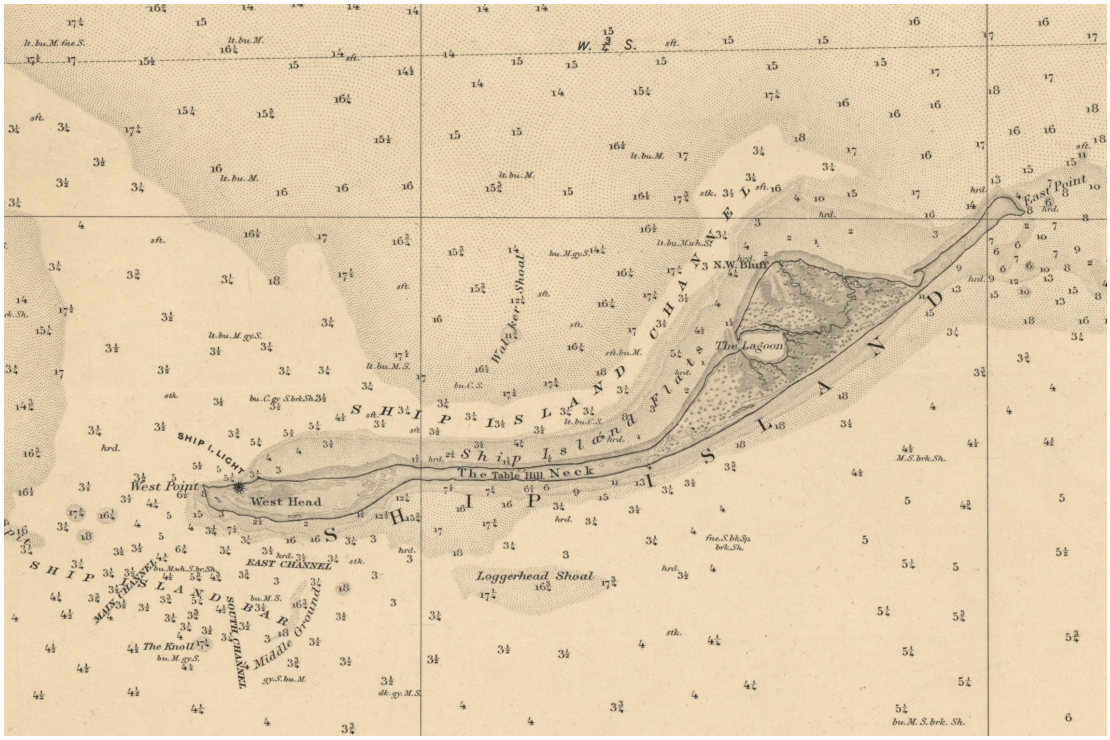
1861 Lines of Equal Magnetic Declination for the Epoch 1860.0

The *Notes on the Coast* assumed access to the *American Coast Pilots*, which concentrated on sailing directions and advice on hazards and the like. But the *Notes* volumes concentrated on much more specifically military-oriented information about the strategic significance of different coastal features and harbors, relationships to railroad lines, and the like. To ensure secrecy, the Government Printing Office was bypassed. Instead, the *Notes* were written in clear cursive writing, not typeset, and then lithographed, on the new lithographic presses that Survey headquarters bought expressly for the war effort. Each volume contained 8 to 12 or more folded maps, combining regionally scaled sailing direction charts, diagrams to wind patterns and tidal patterns, and harbor and nautical charts for the area in question. The charts were all lithographs, derived by photographic transfer from copies of original engraved charts. Each of the 12 volumes was produced as, essentially, a "paperback" without hard board covers, making them easy to protect and conceal under a coat.

How the *Notes* both depended on the *American Coast Pilots*, yet differed from them, may be illustrated by their joint descriptions of the same important channel in Mississippi Sound. The area was charted in 1860 on one of the "inexpedient" charts missing from the annual report for that year. The chart depicts a long low sand island, Ship Island, and a relatively deep channel parallel to the island on the north. The channel and its context are described by the *American Coast Pilot* this way:

> *"West from Ship Island is Cat Island, between which the distance is 5 miles. There is a bank which puts off from Cat island, towards the west end of Ship island, having a channel of only a mile wide, which turns round the West end of Ship Island, in which there are 18 feet."*

1860 Chart 90 Western Mississippi Sound from Round Island to St. Joseph's Island

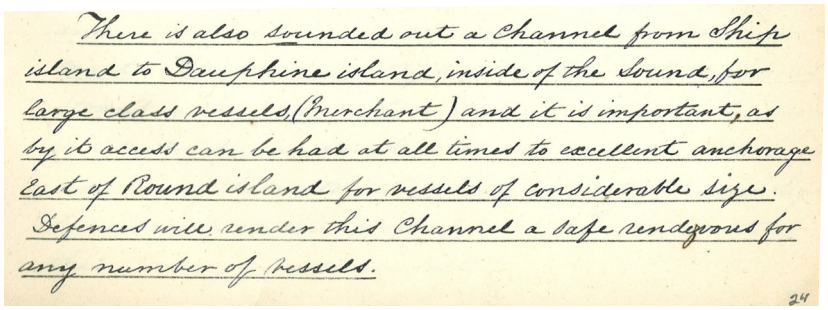


Ship Island and Ship Island Channel, from Chart 90

That very channel was the specific objective of one of the Blockading Board's memoirs. The *Notes on the Coast* describes it this way:

> "*There is also sounded out a channel from Ship Island to Dauphine Island inside of the Sound, for large class vessels (merchant) and it is important, as by its access can be had at all times to excellent anchorage east of Round Island for vessels of considerable size. Defences will render this Channel a safe rendezvous for any number of vessels."*

The *Notes on the Coast*, in the larger sense of the memoirs and the associated maps and scientific aids, were so effective that they were thoroughly utilized. (Of the 12 memoir volumes, the NOAA Central Library Rare Book Room retains the text, but not the attached maps, of eight of the 12 volumes.[10])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24

1861 Mobile Bay and Mississippi Sound volume, p. 11 Notes on the Coast

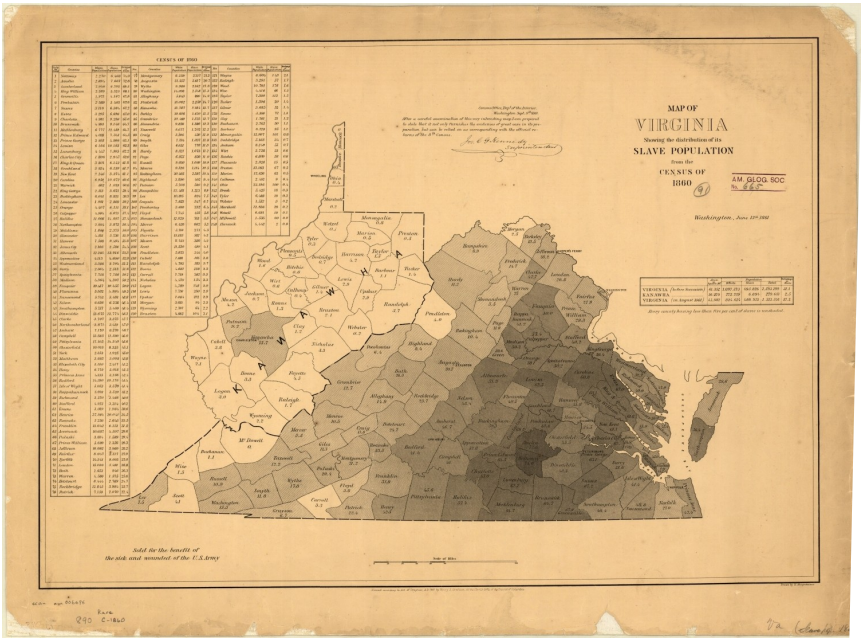
Within a year or so more, there was no point to the secrecy of the memoirs—the Union navy was using them in all the seas of the rebellious states. Bache, in his annual report for 1861, noted:

> *"The survey has thus made considerable progress on the southern coast, notwithstanding the untoward circumstances of the time…The material in the Coast Survey office was rapidly put in the shape of hydrographic notes, and by lithographic and photographic processes the unpublished maps and charts, and memoirs of the coast, were placed at the disposal of the departments of the government, and of the officers engaged in consultations in regard to or in the execution of operations along the coast."*[11]

Coast Survey and the slavery maps

The Civil War was fought on battlefields and harbors, but also in houses and taverns and public squares. It was a political as well as a military campaign, unlike any ever seen in American history, but also closely related to struggles over slavery and secession that went back at least a century before the outbreak of war. On the eve of conflict, the Coast Survey published two of the most important battle maps for the coming war. They were battle maps in the same sense that Harriet Beecher Stowe's novel *Uncle Tom's Cabin; or, Life Among the Lowly* was a call to arms.

In June 1861, the Coast Survey prepared a unique map, lithographed by a commercial printer, which showed the proportions of the slave populations of each of the counties of the state of Virginia, based on the data from the recently released 1860 Census. In September of 1861, the Survey completed a revised version of the Virginia map, and also a larger map, showing the same slave proportions of county populations for all of the Southern slave-owning states. The maps were utterly different from anything the Coast Survey had ever produced. They were associated with the U.S. Sanitary Commission (of which A.D. Bache was Vice President) and "Sold for the benefit of Sick and Wounded Soldiers of the U.S. Army."

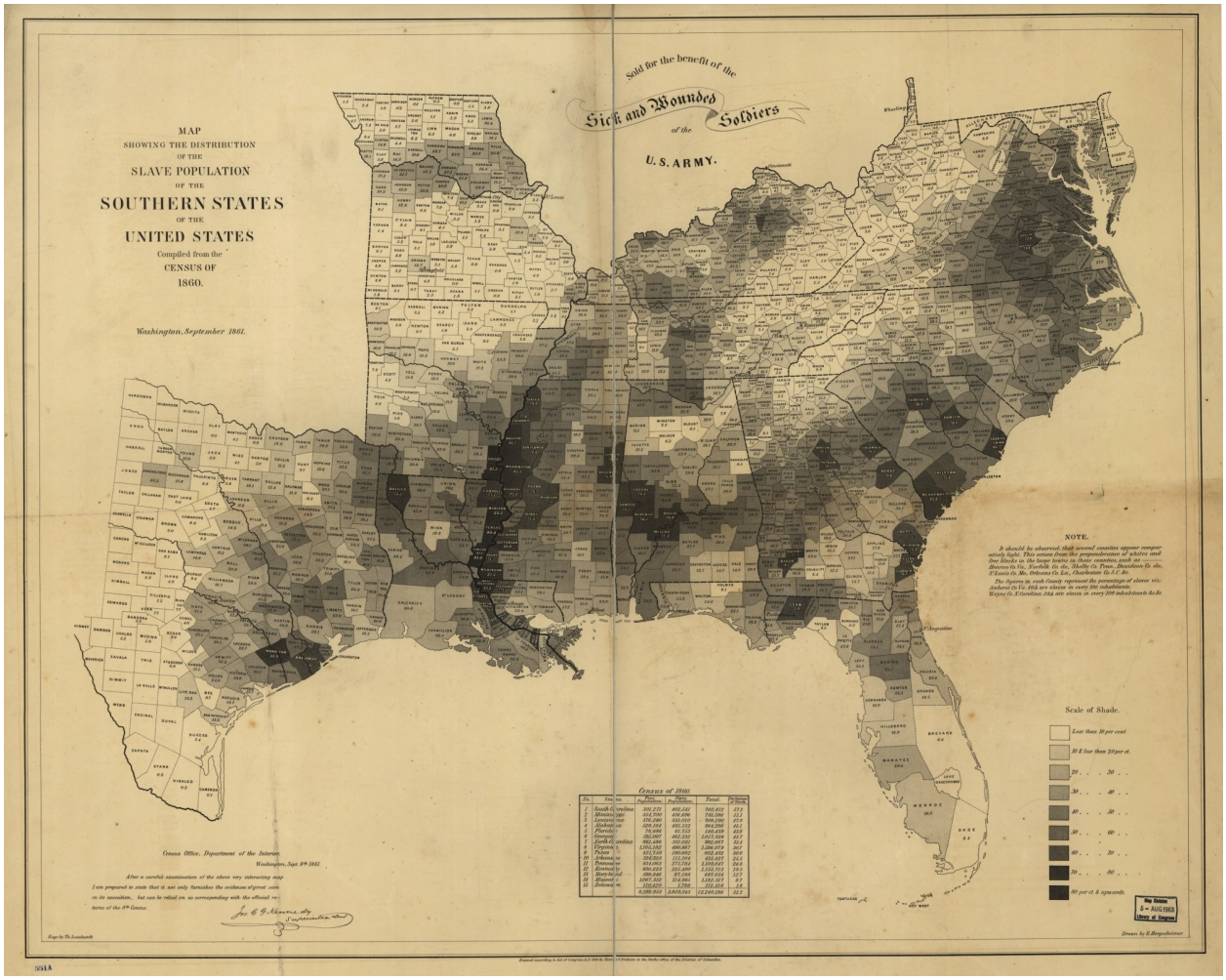


1861, Map of Virginia showing the distributions of the Slave Population from the Census 0f 1860

Geographical Society Library, image am006096

1861, Map of the Distribution of the Slave Populations of the Southern States of the United States compiled from the Census of 1860, by Edwin Hergesheimer.

Library of Congress

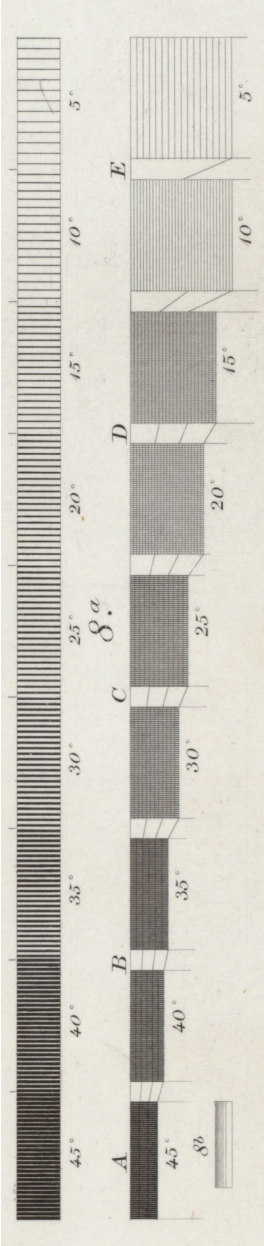


The maps are also landmarks in the emerging cartographic practices for mapping statistical data, and an important prelude to the *Statistical Atlas of the 1870 Census*.[12] This enterprise was not designed for the war, and, in fact, had long preceded it. Superintendent Bache had taken over the Survey in 1843, following Ferdinand Hassler's sudden death. Bache accelerated production of Hassler's first maps of New York Bay and Harbor, but he also developed an entirely new plan for mapping. Many years later, in the 1860 annual report, Bache looked back at an experimental process that had lasted over a decade. As he noted:

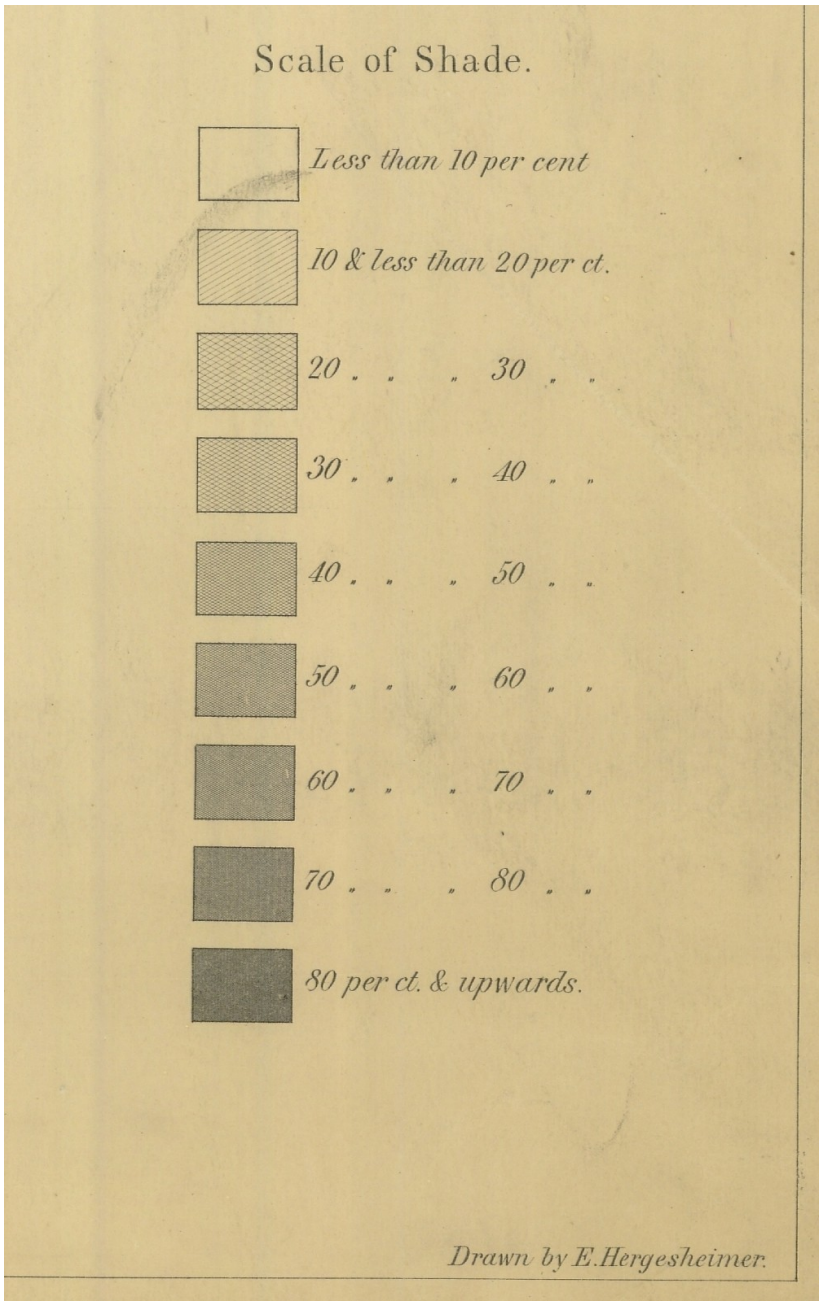
> *"In 1845 and the years immediately following, the subject of style of drawing and engraving the maps and charts of the Survey were discussed in great detail… Besides, large numbers of maps had been printed, and the criticisms upon them by navigators and others had enlightened us on many doubtful points. The labor, too, of engraving the first class charts in the style adopted had, under the most favorable circumstances, proved greater than was expected. But above and before all other reasons, photography was to be introduced as a regular part of office detail, and great changes were necessarily consequent. I determined therefore to have a thorough revision of the whole system; to re-establish approved rules and usages, and carefully to study new ones; to avail ourselves, in short, of the experience acquired in the field and office for a new step in improvement. Assistant H.L. Whiting, whose experience in field topography is greater than that of any other assistant, and whose success in all matters of relating to representations of ground in the field and office is very great, was ordered to the office to study the whole subject."*[13]

The systematic re-evaluation of the entire cartographic process included many elements, but one in particular bears attention. As Bache noted, "[t]he subject of the scale of shade, by which ground is represented by hachures, was carefully gone over."[14] Translated into modern terms, the discussion was on systems to convey the form and steepness of slope of hills and terrain, using sets of engraved or incised lines that darkened or lightened in ways to convey the changing slopes graphically. There were a number of major European systems already in use, but these were found insufficiently appropriate, at the extremes of slopes, both very shallow and very steep, to express the changes in terrain as well as Bache and company wanted. Under Whiting's direction, Edwin Hergesheimer, one of the most skilled of the draughtsmen in the Survey, who eventually became head of the Drawing Division, executed a series of graphics trials, using the complex terrain around Ipswich, near Cape Ann, Massachusetts, as a test case. Eventually they developed a hybrid scale of shade, which worked for the Survey. "This scale is at once practicable in execution and graphic in effect, and adheres with sufficient closeness to that of the existing maps, avoiding some practical difficulties which experience had developed in representing the lowest and highest slopes."[15]

Thus in 1860, on the eve of war, the Survey had completed a review and improvement of the entire system of cartography as practiced since Bache's arrival. One of the first major applications of the new systems was the display of the slavery populations in the Southern states, where Coast Survey adapted the new system of hachures to display topographic relief to the task of political and moral relief. The system, originally developed to show classes of angles of slope from shallow to steep, was adapted to display population proportions in 10% increments. A comparison between the new standardized schematic for "Orographical Design" and the Scale of Shade for the slavery maps makes the adaptation clear.



1860 Elementary Rules for Orographical Design, by J. Enthoffer, Chief Engraver, U.S. Coast Survey. See Enthoffer, 1860



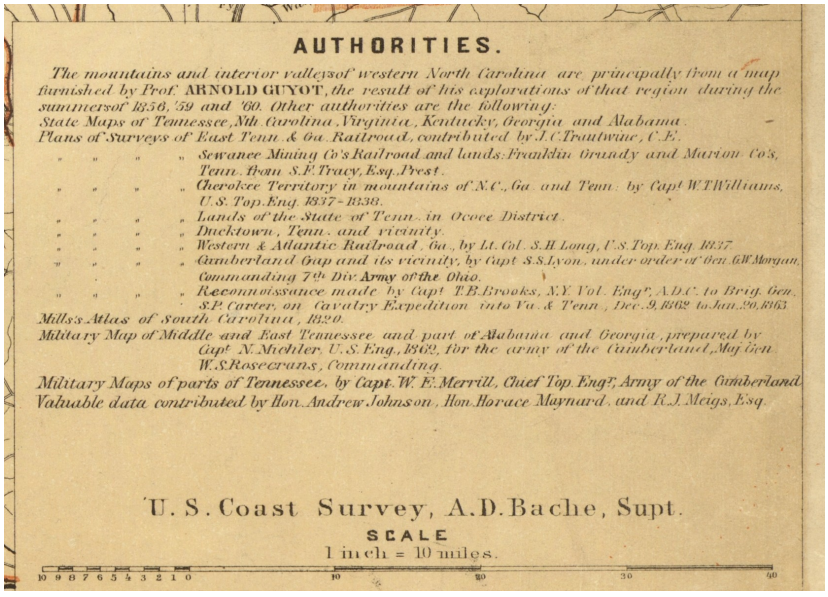
Scale of Shade, from Map of the Distribution of the Slave Populations of the Southern States of the United States compiled from the Census of 1860 (September 1861), by Edwin Hergesheimer. Library of Congress.

Mapping the New Coast of the Rebellion

As noted in Albert Theberge's history of the Coast Survey, a not insignificant aspect of the service of the Coast Survey in the Civil War was that an entire generation of Union Army and Navy officers and personnel had been trained in geodesy and surveying from service with the Coast Survey. Importantly, they had received their training in many of the most critical geographical areas where the later war was fought.[16]

Survey crews accompanied all the major nautical campaigns of the war in the southern states, as fully described in the Theberge history. This had the effect of familiarizing the Survey with river hydrology and riverine surveying. Before the Civil War, the Survey traditionally surveyed the hydrology and associated topography of coastal estuaries and rivers only to the head of tide (which, in the case of the somewhat anomalous Hudson River, was over a hundred miles inland, above Albany, the capital). During the war, Coast Survey ascended strategic rivers far inland, fighting their way upriver, on the Mississippi, the Ohio, and, above Chesapeake Bay, the York, Potomac, Rappahannock, James and other Virginia rivers. These rivers were far above the head of tide, with hydrologies far different from those of estuaries.

The terrestrial battles of the war in the south had much to do with massing and transporting huge armies and their supplies, with sieges and attacks, with rapid movements and with railroads. In response, the Coast Survey developed unique series of territorial maps, derived from a variety of sources. They were unlike any maps the Survey had ever produced, in several respects. In order to accomplish this, the Survey created an entire new division in the headquarters. "*Lithographing Division* — This division, which was organized and added to the office establishment during the month of May, 1861, to meet the increased calls for charts arising out of the exigencies of the war, has been continued in active operation under the charge of *Mr. W.L. Nicholson.*"[17] Nicholson was one of the leading lithographers of the era, later to be the chief cartographer of the U.S. Post Office.


AUTHORITIES.

The mountains and interior valleys of western North Carolina are principally from a map furnished by Prof. ARNOLD GUYOT, the result of his explorations of that region during the summers of 1856, '59 and '60. Other authorities are the following:
State Maps of Tennessee, Nth. Carolina, Virginia, Kentucky, Georgia and Alabama.
Plans of Surveys of East Tenn. & Ga. Railroad, contributed by J.C. Trautwine, C.E.
" " " " Sewanee Mining Co's Railroad and lands, Franklin County and Marion Co's, Tenn. from S.F. Tracy, Esq., Prest.
" " " " Cherokee Territory in mountains of N.C., Ga. and Tenn. by Capt. W.T. Williams, U.S. Top. Eng. 1837-1838.
" " " " Lands of the State of Tenn. in Ocoee District.
" " " " Ducktown, Tenn. and vicinity.
" " " " Western & Atlantic Railroad, Ga., by Lt. Col. S.H. Long, U.S. Top. Eng. 1837.
" " " " Cumberland Gap and its vicinity, by Capt. S.S. Lyon, under order of Gen. G.W. Morgan, Commanding 7th Div. Army of the Ohio.
" " " " Reconnissance made by Capt. T.B. Brooks, N.Y. Vol. Engrs, A.D.C. to Brig. Gen. S.P. Carter, on Cavalry Expedition into Va. & Tenn., Dec. 9, 1862 to Jan. 20, 1863.
Mills's Atlas of South Carolina, 1820.
Military Map of Middle and East Tennessee and part of Alabama and Georgia, prepared by Capt. N. Michler, U.S. Eng., 1862, for the army of the Cumberland, Maj. Gen. W.S. Rosecrans, Commanding.
Military Maps of parts of Tennessee, by Capt. W.E. Merrill, Chief Top. Engr. Army of the Cumberland.
Valuable data contributed by Hon. Andrew Johnson, Hon. Horace Maynard, and R.J. Meigs, Esq.

U.S. Coast Survey, A.D. Bache, Supt.

SCALE
1 inch = 10 miles.

10 9 8 7 6 5 4 3 2 1 0 10 20 30 40

1863, Authorities Section, Mountain Region of North Carolina

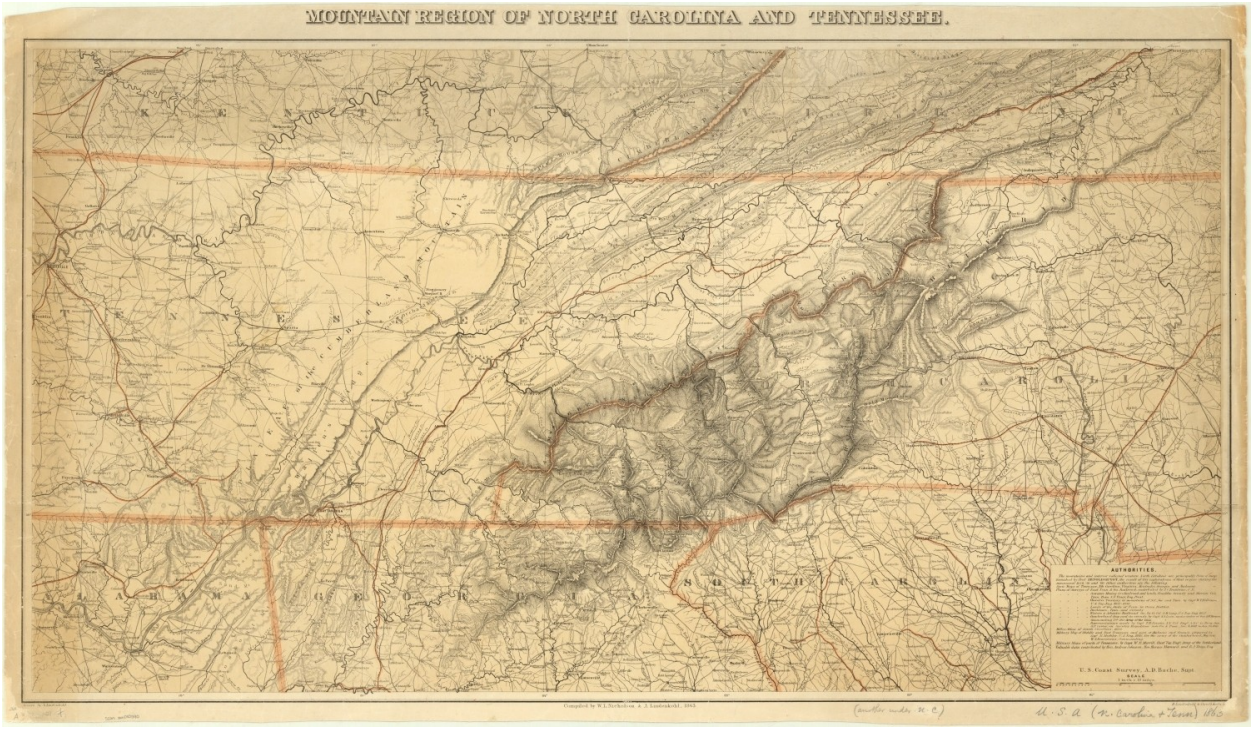
The new series of maps were derived from many sources, including new Survey work, but also incorporating the maps of many other people and institutions (always carefully referencing the sources).

The map displayed on the next page particularly singles out cartographically the central terrain unit with intricate shaded-relief topography derived from Arnold Guyot, the first American academic geologist, who worked closely with the Survey.

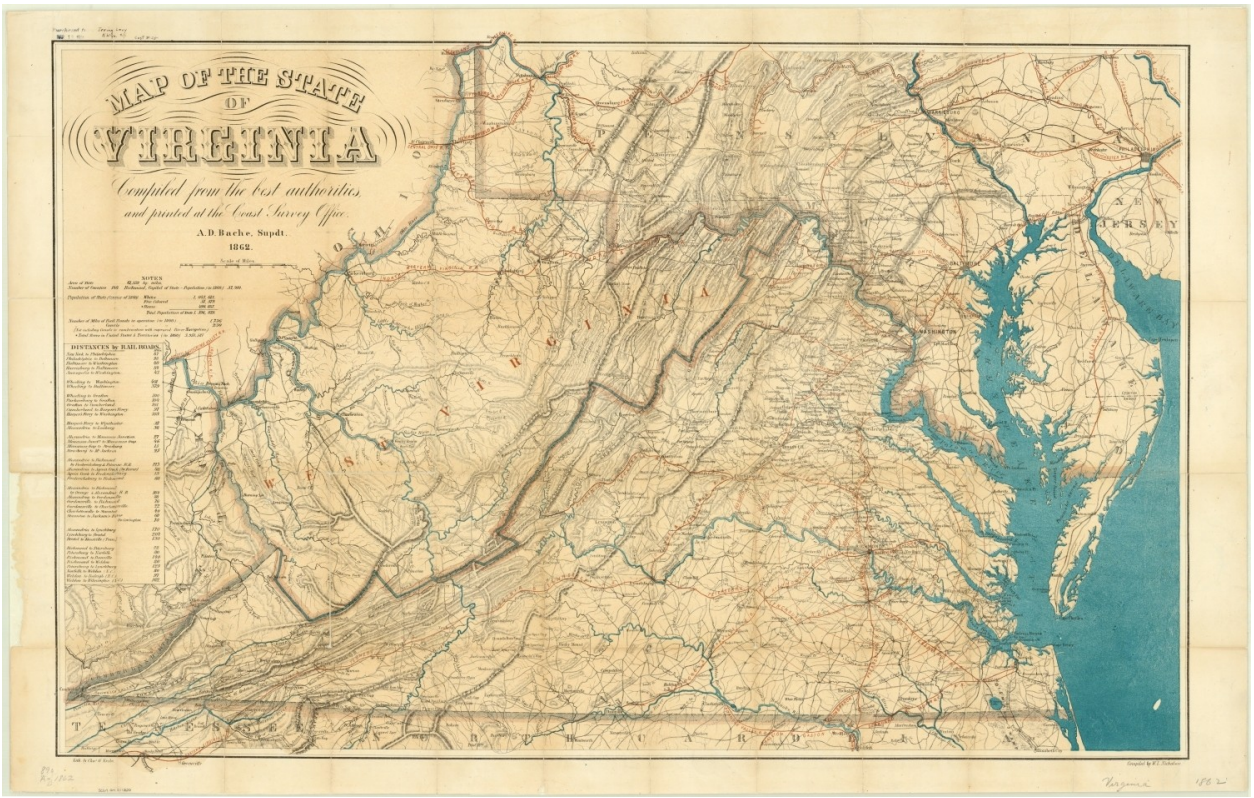
The maps the Survey produced and distributed included those designed primarily for military use, and also maps produced for general public use, to allow citizens to follow the progress of the war as the campaigns fought on. These became extremely popular and sought after, from their inception. As W.L. Nicholson noted:

> *"In addition to the printing of our charts proper, a map representing the seat of war in Virginia was, at the suggestion of the Superintendent, compiled by myself during the past year, and printed in colors, partly as*

an experiment in that class of work, and partly to meet the popular demand for information on the movements of our armies. This map has met with unexpected success, and has been much called for, and



1863, Mountain Region of North Carolina and Tennessee, American Geological Society Library, scan am10590



1862, Map of the State of Virginia, AGSL image am0011220

copies quite freely distributed but, in order to cover the expenses of its getting up and printing, a number of copies have been placed in the hands of our sales agents, the proceeds of which have more than covered expenses; in all some five thousand five hundred copies have been printed, over twenty-five hundred sold, and nearly three thousand copies gratuitously distributed."[18]

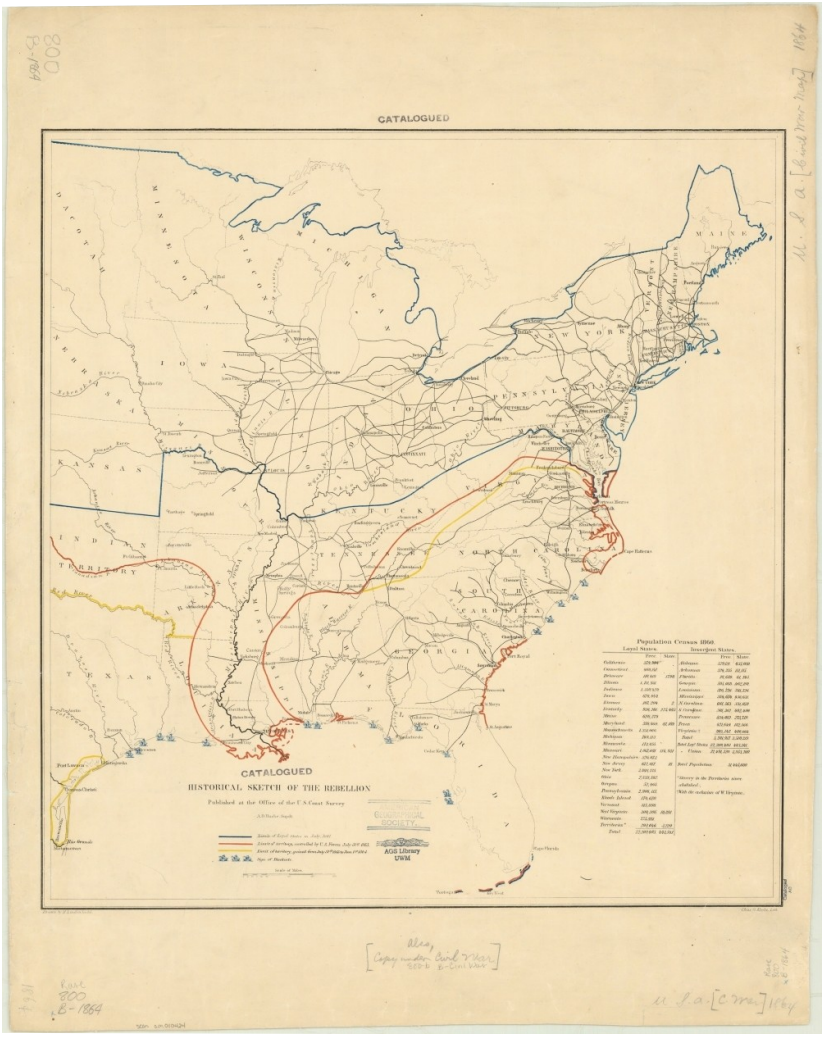
The success of the war maps for the public even influenced the design and production of the very specialized military maps the Survey produced for the Army and Navy. As Nicholson noted: "Our experience with this color-printing has been of service in the proposed treatment of some of our regular preliminary charts and sketches by representing gradations of soundings, land, sand-banks, &c., by a system of light coloring. This method will be prosecuted as the pressure of work may permit."[19] A particularly effective use of the chromo-color technique is displayed in the Survey's chart of approaches to Mobile Bay, Alabama.

1864, Approaches to Mobile, Alabama

The utility and iconic status of these Coast Survey maps for the Union war effort is captured in Francis Carpenter's painting of 1864, which hangs in the Senate wing of the U.S. Capitol, of Abraham Lincoln preparing to read the Emancipation Proclamation to his cabinet for the first time. The two maps visible in the painting are the slavery map and the map of the state of Virginia, both produced by the Coast Survey.

1864, First Reading of the Emancipation Proclamation, by Francis B. Carpenter

And the war continued. The best source of the story of Coast Survey personnel on the battlefields and on the seas and rivers during the conflict remains Albert Theberge's history, which should be consulted directly.[20] Their work, and associated cartography, was largely confined to specific engagements and battles. On a more "global" level, back at headquarters in Washington, the Survey pioneered a unique way of describing the progress of the war. They essentially redefined the coast politically, as the boundary between the territory of the Union, and the territory of the Rebellion. In a time series of maps from 1862 through at least 1864, they presented the changing boundary, or "coast" of the rebellion.

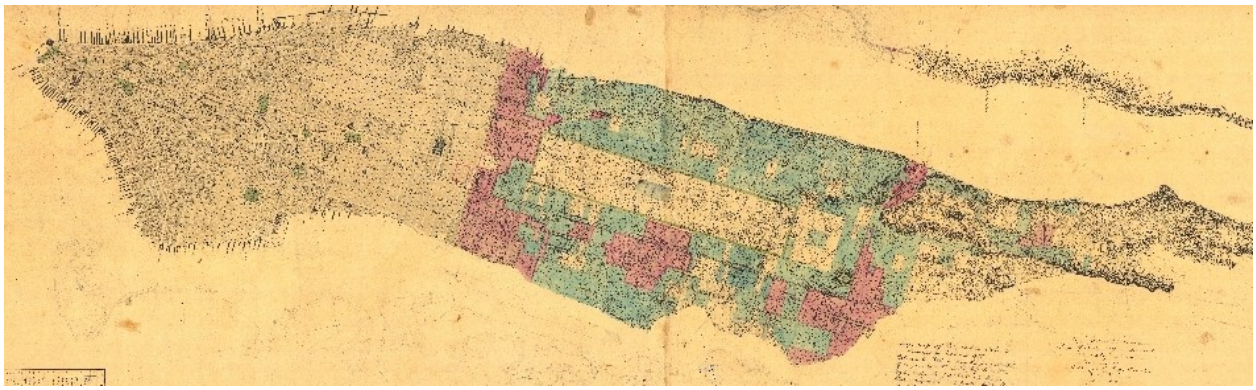


1864, Historical Sketch of the Rebellion, as of January 1

While most attention has been focused of Survey personnel and their work in the areas where the war was actively fought, the Survey was also very active in hydrographic surveying in the northern parts of Chesapeake Bay, in Delaware Bay, and in various critical harbors during the duration of the war. In part, especially during the period that Philadelphia was threatened by Confederate attack, the surveying was a part of major preparations for defense against attack.

1861-62, Delaware River vicinity of Fort Mifflin

Elsewhere, Survey work was dedicated to accommodating increased demands on northern ports and supply systems for war materials and passage of goods and people. There was also complex civil unrest in the north. In July of 1863, the New York City draft riots began; they were the largest and most deadly civil disorder in American history. Several months previous to that, Ferdinand Gerdes, between assignments with Admiral David Porter, headed a Survey team that extended the Survey topographic surveys of Manhattan begun in the 1840s, with updated color codings on a special copy of the Manhattan t-sheet, to code different patterns of urban development underway on the island. It is unclear what Gerdes assignment, "to show the current state of improvements in the City" might have meant to the social relations in the north at the time, but it is, again, an example of Survey personnel working on projects and themes unlike those they had done before the war.



1863, T475B, Manhattan with color-coded levels of urban development, by Ferdinand Gerdes

Eventually the war concluded. Virtually every aspect of Bache's strategy for the Survey -- the blockade, the new and innovative map series, and much else -- had proved original and successful. Sadly, Bache was not able to experience the fruits of his labor.

The Aftermath of the War and Bache's Death (1865-1867)

Alexander Dallas Bache's health declined as the war progressed. While overseeing construction of fortifications to defend Philadelphia against possible attack in May 1864, Bache suffered some sort of debilitating stroke or other disorder. The exact nature of his ailment was not known then, nor has been surmised since. The effects were mental as well as physical, which meant that Bache was no longer a real participant in understanding his condition or possible treatments.

At this critical point, when Bache was so abruptly incapacitated, much of the center of mass of the Coast Survey shifted to Joseph Henry, Bache's closest friend and confidant, the Secretary of the Smithsonian Institution. Most of what we know of Bache's condition and the Survey's perilous course comes from Henry's correspondence to others, and especially his confidential letters to Nancy Clarke Fowler Bache. Bache's wife and now caregiver. The clearest description of Bache's mysterious malady comes from Henry's letter to John H. Lefroy, a British artillery officer, who was the director of the Canadian magnetic observatory from 1842 to 1853 and, thus, Henry's fellow scientist in magnetic research:

> *"There are conditions of those we love and have respected worse than death; my friend Professor Bache with whom I have been on terms of the greatest intimacy was suddenly stricken down about two years ago in the midst of his responsible duties as head of the Coast Survey and is now in the last stage of animal existence, does not recognize his friends and is gradually fading away in body as well as in mind. He was overworked during the war, was seized with paralysis and softening of the brain."*[21]

That Bache was incapacitated was immediately apparent. However, for the next two years, until Bache's death in February 1867, both Henry and the leadership of the Survey took pains to prevent outsiders from knowing the nature and extent of Bache's maladies. There were three major reasons for this, all inter-connected. First, prosaically, as long as Bache was the nominal leader of the Survey, he, or more specifically his wife Nancy, would continue to receive his salary as Superintendent, which she needed to live on. Second, maintaining Bache as the nominal leader would allow Survey to maintain its activities uninterrupted, and to secure its Congressional appropriations without unnecessary scrutiny of its operations. Assistant Julius Hilgard became the de facto leader of the Survey, with Henry playing a variety of complex roles, particularly as related to disparate members and committees of the U.S. Congress, the National Academy of Science, and the Smithsonian Institution. Third, as long as Bache was the nominal leader of the Survey, there was no struggle to appoint a successor.

At the same time, it quickly became apparent to Henry, Hilgard, and many others that Bache was finished, and that his successor would need to be found and installed. A raging debate and series of forays and campaigns on behalf of different potential leaders occurred between 1864 and 1867.

The developing struggle over Bache's successor was also complicated by new proposals, a constant of the history of the Survey, to remove it as an independent scientific agency under the Secretary of the Treasury, and move it under military control. Traditionally, the U.S. Navy attempted to take over the Survey or acquire responsibilities for hydrography in domestic waters, making the Survey superfluous. However, in the aftermath of the Union victory in 1865, Ulysses S. Grant proposed bringing the Survey under the control of the Engineer Bureau of the U.S. Army. As Henry noted to Nancy Bache:

> *"General Grant went out of his way to say that the Coast Survey ought to be put under the charge of the Engineer Department of the Army. On the other hand, the Navy Department has introduced a bill to the Senate for the establishment of a hydrographic bureau which appears to look towards the Coast Survey. The Secretary of the Treasury thinks the Survey ought to remain where it is under his charge, and that the fight between the Navy and the War Department for the possession of it will end in the defeat of each. What an ambitious world we live in?—not ambitious to do good but to advance individuals."*[22]

On February 17, 1867, Alexander Dallas Bache died, in Newport, Rhode Island. Preparations for his demise had long been underway. Bache's body was first brought to Philadelphia, his first home. Ceremonies were held in the chapel of the University of Pennsylvania, where he had been a professor. Members of the many other institutions in Philadelphia he had founded or been a member of attended. Then his body was brought to Washington, his second home, escorted by the leadership of the Coast Survey. The Congress was

consulted about his body lying in state in the Capitol. The only precedents for this required Congress to adjourn for the day, but the Congress was in session, and duties at hand included passing an appropriation for the Coast Survey. Therefore, instead, and appropriately, the entire ceremony in Washington was in the facilities of the Coast Survey, and under the direction of Bache's staff. Survey headquarters on New Jersey Avenue was closed, and draped in black. A procession formed there, with virtually the entire body of the staff of the Survey in attendance. They walked to Bache's residence for the funeral ceremony. Afterwards, Bache's body was carried to the Congressional Cemetery and laid to rest.

That evening, Henry wrote in his private diary:

> *"Funeral today of my old and highly respected friend Professor Bache. I have been more intimately acquainted with him for the last 34 years than I ever was with anyone except my own wife. The occurrence of his death would have been overwhelming had it happened suddenly but since he has died off as it were very gradually his departure at the last was not a matter of much sorrow. Indeed it was a relief to all connected to him."*[23]

And thus the greatest leader of the U.S. Coast Survey, who guided the Survey in the war, was also essentially Coast Survey's last casualty of the Civil War.

A.D. Bache tomb at Congressional Cemetery, Washington, D.C.
Photograph by Don Connelly

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